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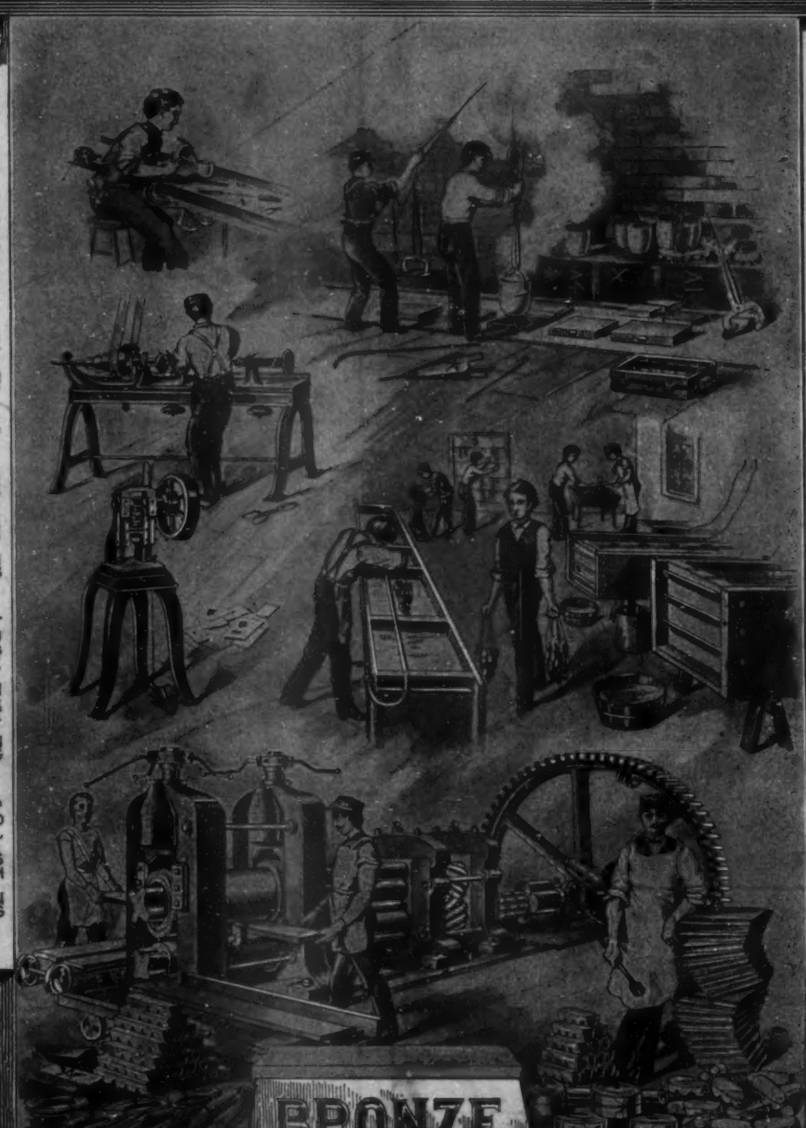

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NEW SERIES Vol. II No. 6.

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JUNE. 1904

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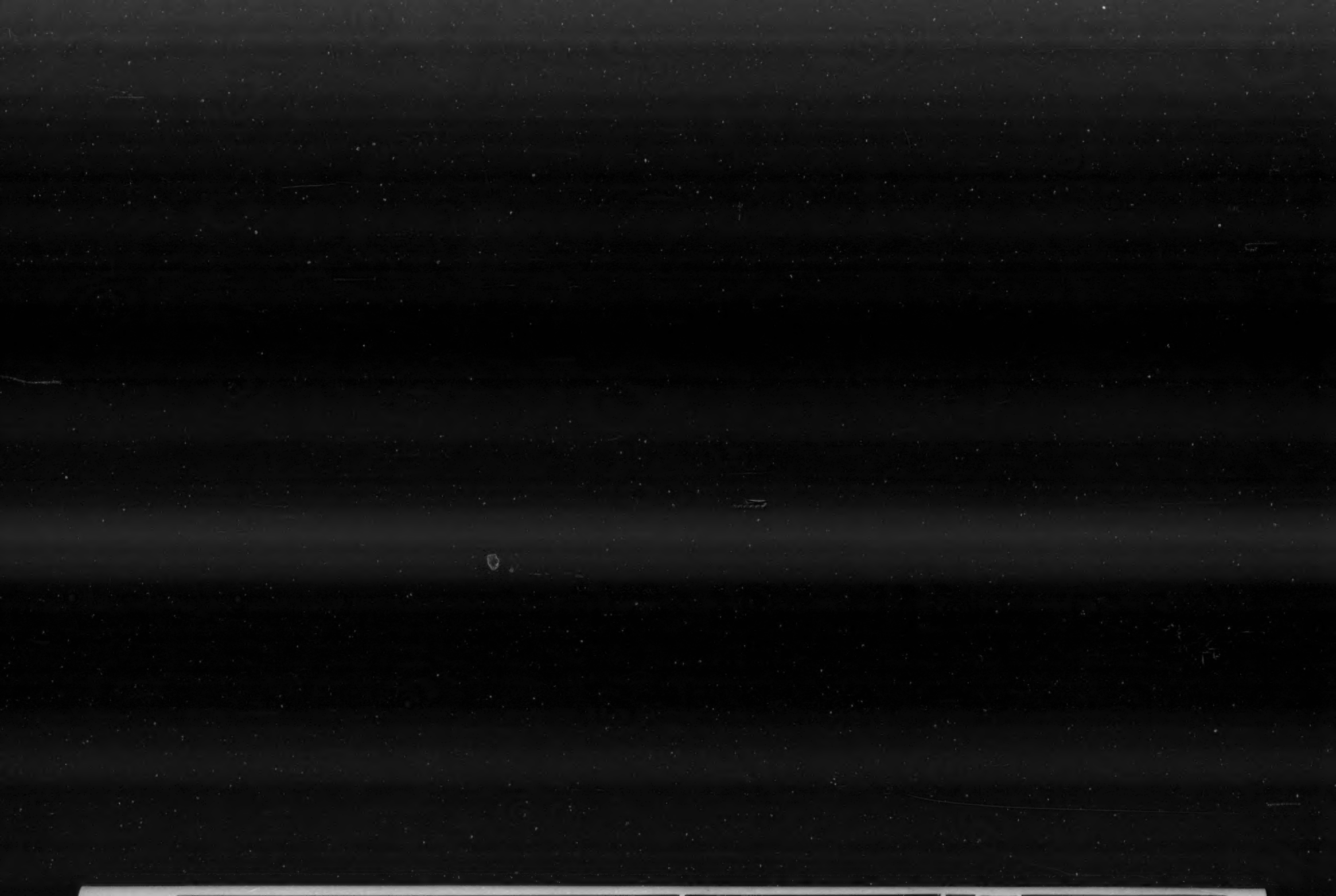

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CONTENTS

	Page.
Editorial	85
Foundry Practice with Copper and Its Alloys	87
Alloying Copper with Iron	88
A New and Cheap Finish for Cast Iron	88
Brazing Cast Iron	88
A New Brass Rod Casting Machine	89
William Wallace	90
Aluminum Bronze Bearings Not Satisfactory	90
Wachwitz Metal	90
The Electro-Welding of Aluminum	91
Silver Deposit Work	92
Ormolu Gold Finish	93
Oxidizing Zinc	94
Plating Watch Cases	94
Welding Lead	94
Verde Antique or Green Bronze	94
A New Form of Jeweler's Mold	95
Polishing and Grinding Motors	95
Made in Germany	95
Correspondence Department	96
Patents	98
Trade News	99

BRONZE GUNS.

The recent statement appearing in trade journals about the return of the Austrians to the use of bronze guns seems to call for a comment on the subject, particularly in the face of the fact that all other nations have abandoned the use of this material for such a purpose. It is said that the Austrians have discovered a secret process for producing a high tensile strength in bronze, and we will not comment upon this point without further investigation. There is one belief, however, in regard to bronze which we think advisable to correct, and that is the idea that high tensile strength is the only property which is required in a metal for the purpose of making ordnance. There are two properties beyond this which are fundamental to the adaptability of a metal or alloy to the purpose of manufacturing guns. The elastic limit and the elongation are the properties which must be considered, and, in reality, tensile strength is of secondary importance in this respect.

Those who in their juvenile days were accustomed to employ the traditional piece of lead pipe for the purpose of celebrating the beginning of this country's existence can readily testify to the absence of any elastic limit in lead. It was soon found that the internal diameter of the pipe constantly increased with each firing until at last the piece of ordnance was unfit for business on account of the rent in the side. And so it is with all known bronzes. Lead has practically no elastic limit; the bronzes one which is quite low. A metal which, when a slight strain is put upon it, stretches but fails to return to its original condition after the strain is removed possesses a low elastic limit and is unfit for use as ordnance. Those metals which are valuable in this respect are the ones which do not begin to take this permanent set until a heavy strain is put upon them and are suitable for the manufacture of large guns. Such materials are, at the present time, only found in the steels, and those who have advocated or tried the use of bronzes for this purpose have invariably been rewarded with disappointment.

All bronzes have a low elastic limit and begin to stretch when a slight load is put upon them, the same, of course, as steel will do, but when the load is released the steel returns to its original condition while the bronze remains in the distorted condition. Although theoretical considerations are invariably valuable, one always feels better satisfied if a trial is re-

warded with coincidence. Working on these lines, we had a rifle barrel made of rolled aluminum bronze rod, the strongest of all known bronzes, and which, before it was made into the barrel, had a tensile strength of 74,200 pounds per square inch, and therefore, compared very favorably in this respect with steel used for the purpose. The barrel had every indication of success until the diameter of the bore was measured after each firing, when it was found that every time this operation took place that the diameter was increased. Of course, such a condition unfitted the bronze for this use.

If our friends in Austria have discovered a method of imparting a high elastic limit and elongation to a bronze with a high tensile strength, they have discovered something hitherto unknown.

DOES IT PAY TO GRIND UP OLD CRUCIBLES?

There seems to be quite a diversity of opinion about the wisdom of grinding up old crucibles. In former times they were thrown upon the dump and no attempt was made to extract the metal which they contained. Later an economical practice penetrated the brass industry, and the opinion prevailed that the crucible was like a sponge and absorbed a large amount of metal. All crucibles were then ground up along with the ashes and it was assumed that such a practice paid. In the majority of instances no attempt was made to find whether the practice was profitable or not. The brass mills continued to grind up their crucibles until the more enterprising ones began to investigate, and when they did, the grinding of the crucibles stopped. The idea that a crucible is like a sponge seems to have passed.

As a matter of fact a crucible actually is porous but not to metal. If we inspect a brass crucible after its life has ceased, it will be found that the metal which it contains exists in two forms. First, as a skin around the inside near the top and occasionally a skull in the bottom with patches of metal scattered here and there all over the inside surface. Second, small amounts of metal which have penetrated holes or cracks in the crucible. All crucibles will sooner or later crack to a greater or less degree, and pin holes form. In each of these cavities metal will penetrate.

Now the best manner to treat such crucibles is to hand-pick them. Let the operative be furnished with a brick hammer and first crack the crucible in half. The skull of metal, the pieces of metallic skin, the metal in the pin holes, in fact all that is usually obtained by grinding the crucible up may be readily obtained in this manner and put with the metal skimmings. After the operative has carefully gone over the crucible, it will be found that the amount of value left is very small. The old crucibles then may be sold for a few dollars a ton. Cheap labor may be put upon the work and as the amount of metal on them is small the operation need not consume much time.

We occasionally hear the statement made that it pays to grind up the old crucibles, but we believe that if all the old crucibles are inspected it will be found that there exists in the bottoms a large number of skulls of metal which the caster or molder has left in when through pouring. The metal becomes chilled and does not completely run out, and when this is the case it certainly would pay to grind them up rather than throw them away. Old crucibles, however, do not grind at all easily, and we are firmly convinced that the hand-treating process is the most economical. Many of the large brass makers certainly seem to think so.

THE PURCHASE OF SCRAP BY THE ROLLING MILLS.

The brass rolling mills have, as a rule, always purchased their own scrap from their customers, but have fought shy of scrap not their own. Many mills have used as an advertisement the fact that they have never purchased any scrap. We have never found any of the brass rolling mills, however, who would not buy their own scrap, so that the statement that they use no scrap is without foundation. The plea in this case is that they know what their own scrap is, while that of other makers is an unknown quantity. And yet they have unwittingly purchased and used scrap of other makers because the large consumers of brass rolling mill products generally buy from more than one maker and the scrap has been shipped back to the rolling mill without assorting it.

Competition among the rolling mills was never greater than it is now, and whenever any money can be saved the opportunity is seized. One of these opportunities exists in the purchase of scrap, and such a practice is now being carried on to a large extent. Some of the mills are now buying very large amounts, but the fact that they are purchasers of this commodity is concealed by not purchasing the scrap directly but through some scrap metal dealer. We have known parties to offer excellent scrap to certain mills only to have it refused, and afterwards buy the same material from a dealer. The dealer acts as the clearing house for the disposal of the goods.

It may be well to add that only good sheet scrap or material which has been rolled or drawn is purchased. Inasmuch as this material was rolled into sheet or drawn into wire at a previous time vouches for its quality. Good skeleton sheet brass can be purchased at a price of about a cent a pound below the cost of the mixture, and is sufficient inducement for its purchase. In fact this amount really represents the profit in sheet brass to-day. We see no reason why the practice should be condemned, and if judgment is used in the purchase of the scrap and it is put into the proper kind of mixture it certainly is considerable saving. A line of mixtures for which the highest requirements are unnecessary should be manufactured and no attempt made to put the scrap into those in which the specifications are severe.

FOUNDRY PRACTICE WITH COPPER AND ITS ALLOYS.*

By W. J. Reardon,

Foreman, Brass Foundry The Westinghouse Machine Company.

Copper and its alloys are very important materials from the standpoint of the electrical engineer, and since a large part of these materials must be shaped by casting, the foundry practice in connection with them becomes important.

The process of casting is apparently simple: Copper is not hard to melt, and, when melted, it is not difficult to pour the fluid mass into a properly shaped receptacle. Sad experience has, however, shown the foundryman that good results cannot be obtained by any hap-hazard methods.

The first requirement is that the copper must be heated to exactly the right temperature. If the heating be prolonged and the metal brought to a bright red heat it becomes "soaked" as it is called. After being poured, there is a period of quietness, and all seems well; suddenly there is a small explosion; the sand is blown from the flask, and the metal at the gate flies in all directions. When the casting is examined it is usually found to bear no resemblance to the pattern. If the heating be incomplete and the temperature too low, the action will be somewhat different, but the result will be no more satisfactory. There will be no explosion, but instead the sand on the copper rises and breaks up; the metal at the gate swells and the liquid copper continues to ooze out for some time. When examined, the casting is found to be full of blowholes, their number depending upon the temperature at which the metal was cast. The effect of overheating or underheating are the same, regardless of the fuel employed—whether coal, coke, oil or gas.

The second requirement is that the sand must have a proper temper, neither too wet nor too dry, experience alone can teach one how to best fill this requirement. If copper is poured into green sand the casting will be full of blowholes. On the other hand, dry sand will not hold together. The foundryman's hardest problem is to produce castings free from blowholes. Sometimes a casting will look all right on the outside, but blowholes are found inside when the piece is turned up. Every job requires instructions from the foreman about the temper of the sand, position of the gates and risers.

At the Westinghouse foundry castings are now being made without difficulty which range in size from one ounce to five hundred pounds. The difficulties were overcome by observing the following rules:

1. Heat to exactly the right temperature.
2. Have the sand at the proper temper.
3. Melt the copper quickly.
4. Keep the metal covered at all times.
5. Never let the metal stand in the furnace when once ready.
6. Add a small amount of silicon copper.

In mixing and melting brass a few simple rules should be observed.

1. Weigh carefully.
2. Melt quickly and uniformly.
3. Prevent volatilization as far as possible.
4. Pour at exactly the right heat.

The first rule may seem needless, but bad results are often traceable to careless weighing.

Pouring at the proper temperature is of the utmost importance. At the present time the temper is estimated by the naked eye, the experience of the melter and skimmer being relied upon to decide when the metal has reached the temperature proper for the alloy and the character of the job to be done.

The use of the pyrometer in the Westinghouse foundry for the determination of temperature has not been attended with great success, chiefly on account of vibration. In other places the instrument has proven unsatisfactory because of its sluggishness in responding to changes of temperature.

A bearing metal resembling glyco-metal has been in the Westinghouse foundry which gives excellent results. It is composed of copper, tin, lead and zinc. This alloy is difficult to make because of the tendency of the lead whose specific gravity is high to settle to the bottom. There seems to be no amalgamation of the lead with the proportions of copper and tin used. To check the precipitation of lead the bottom of the casting was chilled with running water, immediately after pouring. This gave good results in small bearings, but did not with large. Finally methods of mechanical mixing were adopted which gave excellent results both in casting and on test. The test showed remarkably low friction and small wear.

Another alloy was made up of the same elements, but a different scheme of mixing was adopted. The mixing was divided into two steps; the first, consisting of making an alloy low in copper, and the second, mixing this intermediate alloy with copper. The intermediate alloy was made by melting the copper first under a charcoal cover and then adding lead, then zinc, then tin; overheating being carefully avoided. This intermediate alloy was poured into ingot molds. After cooling, it was put into melted copper. The resulting alloy could be cast in sand and withdrawn while red hot without showing any signs of lead sweating out, although the temperature of the casting when withdrawn was far above the melting point of lead. The temperature must be watched very carefully, as a slight excess causes the lead to segregate, and chiefly for this reason, the alloy cannot be made in a Swartz furnace.

In the melting of alloys it is customary to melt first the constituents having the highest melting point, then add the others in the order of their melting points, the one with the lowest melting point being added last. Sometimes, however, metals will alloy at a temperature below that of the melting point of some of the constituents. For instance, a brass may be made by first melting zinc, which melts at about 800 degrees F., then taking the crucible out of the fire and adding solid copper whose melting point is about 2,000 degrees F.

A singular point about alloys containing lead and tin is that lead will separate out if the percentage of tin is considerably in excess of that of lead but by decreasing the percentage of tin and increasing that of lead the larger proportion of lead alloys without difficulty.

There is an alloy known to the trade as plastic bronze, which contains 20 per cent. of lead. This large amount of lead is probably held by a small amount of tin and nickel. The alloy gives excellent results.

In the Westinghouse foundry, the molding machines are arranged in two rows, one on either side of the middle aisle. The conveyors, one over each

*A paper read before the Electric Club.

row, carry the sand from spouts which discharge into the flask. The operator, by opening a gate in the spout, allows sand to pour into and fill the flask. When ready for pouring the flasks are set in line along the grating, and as soon as the metal has been poured and is cool enough, the flasks are dumped on this grating, through which the sand passes to an automatic riddle. The riddle catches and throws out all scrap, nails, etc., and the sifted sand is carried by belt conveyor to a set of rolls. After passing through the rolls it falls into a self-dumping pan where a certain amount of water is added, bringing it to the right temper. An elevator takes the sand as it was dumped in the pan and carried it to the overhead conveyor to be used over again.

The sand gave no trouble when the distance handled was fifty feet or less, but after a longer haul it was left in such condition that it would not hold together when the hot metal struck it, but washed away like so much powder, losing entirely the shape of the pattern. When examined under the microscope this sand was found to be entirely disintegrated; the grit and the loam was separated, and formed into globules that would not stick to each other. The difficulty was overcome by passing the sand, after being discharged from the flask and riddled, between a set of chilled rolls. These rolls have to be kept in good shape, for, as soon as they became worn, the sand returned to the disintegrated condition.

ALLOYING COPPER WITH IRON.

The alloying of copper with iron has always been an attractive proposition and much time and many experiments have been wasted on attempts to produce such an alloy. Copper will absorb a small amount of iron (a few per cent. only) when the two metals are melted together. By the use of an alloy of iron and manganese, containing from 10 to 20 per cent. of manganese, still more iron may be made to alloy with the copper, but in either case there is usually found nodules or pellets of iron in the castings, uncombined and forming a dangerous foreign material. Heretofore, the attempts to form a homogeneous alloy of copper and iron have not proven commercially successful.

James D. Darling, of 4826 Greenaway avenue, Philadelphia, Pa., claims to have discovered a process for making alloys of copper and iron in a perfectly homogeneous condition so that there results an alloy which may be used for various purposes. The process consists in melting copper with a mixture of oxide of iron and calcium carbide which gives, after being properly treated, the above mentioned alloy.

Any oxide of iron may be used, the ordinary hematite ore of a good quality or the black oxide, if desired. The calcium carbide is familiar to nearly everyone and is used for the production of acetylene gas. A mixture of three parts of the oxide of iron and one part of calcium carbide is made, and, if it is desired to obtain a 50 per cent. alloy of copper and iron, eighteen parts of this mixture should be used to eight parts of copper. The copper is melted in a crucible in the usual manner and the mixture added in small portions at a time. The bath is stirred from time to time and the temperature raised gradually. This is necessary on account of the gradual reduction of the oxide to metallic iron. When the operation is completed the alloy of copper and iron now produced may be poured into ingots or any other form desired.

If an alloy high in iron is desired, say one containing 85 per cent., then the order of things is reversed. Instead of the bath of copper, one of iron is substituted, and, instead of a mixture of oxide of iron and calcium carbide, one containing copper oxide and calcium carbide is used. In each case the mixture of the oxide and calcium carbide is made in molecular proportions. This, in the case of the oxide of iron and the calcium carbide, amounts to about three parts of the oxide to one of the carbide.

Mr. Darling offers as the reason for the production of this homogeneous alloy of copper and iron that the iron is presented to the copper in a nascent condition and the presence of oxide, which prevents the ordinary union of copper and iron, is avoided.

A NEW AND CHEAP FINISH FOR CAST IRON.

A new and cheap finish for cast iron, steel, malleable iron, etc., has recently been brought out which seems to commend itself for its cheapness and the expedition with which it may be done. The tendency at the present time is to do things on a large scale and by this process the articles may be treated so as to produce the finish with little labor.

It is a well-known fact that all articles of the above nature when tumbled in a tumbling barrel abrade each other and produce a very fine, metallic powder. This powder is utilized for coating the objects in the following manner:

The articles to be coated are tumbled in sawdust to remove the grease and oil and after being tumbled for the proper length of time will be found to be coated with a fine powder formed by each article grinding the others. The articles are now removed without wiping at all, to another *perforated* tumbling barrel and a quantity of varnish added. The amount of varnish to be used is determined by the finish desired but usually an ounce to 100 lbs. of castings answers. After the varnish has been added the objects are tumbled for a period of an hour. The articles are now removed from the tumbling barrel and deposited in such a position that they will readily dry. When dry the articles will have a finish similar to planished steel.

The varnish used may be any kind suitable for the purpose, but should not be one which will dry too quickly. The finish produced is formed by the small particles of iron becoming absorbed by the varnish.

BRAZING CAST IRON.

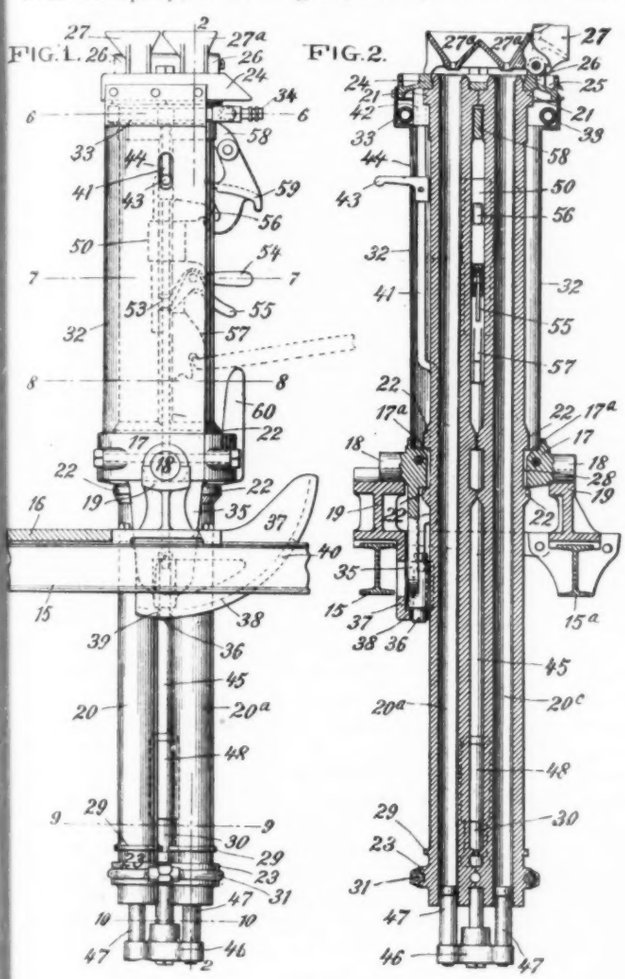
There have recently been several processes brought out for brazing cast iron, and much has been written on the subject. Joseph E. Tichon, of New Bedford, Mass., brazes cast iron in the following manner: The two joints to be brazed are first cleaned and made bright and then dipped in hydrofluoric acid. The joint is next covered with a paste, made of finely divided iron and a mixture of boracic acid and borax. He says that a mixture of borax and boracic acid works better than borax alone, as it does not swell as readily. It melts at a higher temperature than borax and a lower one than boracic acid and does not flow as readily, and hence can be kept in place easily. Equal parts of borax and boracic acid are used. He calls the mixture "boro-boracic" acid. The "boro-boracic" acid is mixed with an equal amount of iron filings (iron by hydrogen is excellent) and placed on the joint, as above mentioned. The work is then brazed in the usual manner.

Iron possesses the property of rendering German silver whiter, and many of the so-called improved white metals owe their whiteness to this element. The iron at the same time hardens the mixture so that less nickel may be used in the manufacture of the alloy and yet have the whiteness preserved.

A NEW BRASS ROD CASTING MACHINE.

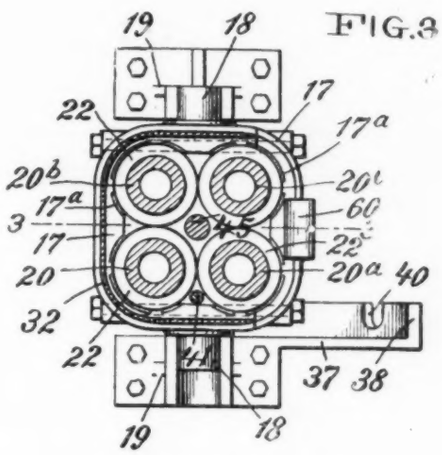
Among the largest uses of brass is that of brass rod. The ever increasing employment of the screw machine and other automatic tools of a similar nature has brought about a demand for brass rod which in the early days of the brass manufacture would not have been considered possible. The ever increasing demand for these brass rods and the competition which now exists in their manufacture has forced the manufacturer to look around to see if some cheaper manner for making rods cannot be had.

Following along these lines Charles F. Brooker, Esq., President of the American Brass Company and The Coe Brass Company, of Torrington, Conn., has invented a so-



THE MOLD.

called rod casting machine for the purpose and which involves several new and valuable features. The rod-casting machine is, in reality, nothing but a mold for casting brass rods or bolts upon which several appliances have been put for tilting the mold, casting the rod, and extracting it after it has been cast. The pouring of the metal is done in exactly the same manner that is practiced in the usual form of mold. The basin or strainer may be used if desired. Mr. Brooker has recently been allowed a patent on his invention and calls it a "Rod-Casting Machine." In connection therewith he says: "My invention consists in a machine for casting rods, and is especially adapted for casting rods of copper or brass or copper alloys, although it may be used with other metals or their alloys. Heretofore it has been the practice to form said rods by pouring the molten metal into sectional holes, such molds divided longitudinally and shaped to form two rods. As the rods formed are usually about 8 feet in length, such molds are situated so that their lower ends will rest in a pit sunk below the floor of the casting room with their upper ends projecting above the floor. The sections of the molds are arranged to be held together by straps. The employment of such molds are objectionable for many reasons, among which are that it requires considerable time to place the molds before casting. The workmen are obliged to enter a pit heated to a high temperature by the molds in order to release the molds from the cast rods, and the rods formed in such molds are of usually different section at their ends, which is due to the shape necessarily given to the molds, which ends must be cut off in order to obtain rods of uniform section, thereby entailing considerable waste and, further, owing to the sectional character of the molds ridges are formed on the opposite sides of the rods, which ridges are often granular in character and otherwise objectionable.



CROSS SECTION OF MOLD.

"The object of my invention is the construction of a machine in which rods of uniform cross section may be produced and which will not require for its operation the expenditure of the amount of labor required with the old system, and, further, which will materially increase the casting capacity of any given floor space of a casting house."

The mold is shown in Figs. 1 and 2. In Fig. 3 is shown the cross section of the mold. The mold is made in four compartments so that four rods may be cast in it. Each rod is cast separately as is usual with compartment molds. Each compartment is provided with a basin 27 and 27a, which is provided with a hinge 26 so that it may be thrown over after the pouring is finished. The groove 24 in the ring 25 is for the purpose of catching any metal which may overflow from the mold. A ring 33, ending in the nozzle 34, acts as a cooling pipe through which water is forced in order to cool the mold after it becomes overheated. Suitable outlets 17 and 17a are provided for the water overflow.

The mold is furnished with trunnions 18 so that it may be readily tilted. The arrangement 37 in the form of the arc of the circle serves to hold the mold when tilted so that the rods may be readily removed. The principal feature of the mold, however, is the device for removing

the rods after they have been cast as in the old form of solid rod mold this is one of the troublesome processes. In 46 and 47 are plugs which enter the bottom of the mold and which, by means of the lever 57, are forced in or out of the barrel. Various catches and hooks 56, 57, 59, etc., serve to hold the plugs in place. When the rods have been cast, and it is desired to release them from the mold, the plugs are pushed up by means of the handle 54 and the rods forced out of the top of the mold in sufficient length to render it possible to grasp them with tongs and fully release them. After this has been done, the plugs are forced out of the barrel and swung around out of the way. The mold may now be cleaned with the swab or brush and oil or blacklead applied as desired.

[Solid rod molds are gradually coming into use for casting brass rods or bolts and certainly form a satisfactory appliance as no fins are formed on them. The main difficulty has been in obtaining sound iron castings so that when the mold is bored the bore will be smooth and free from holes or flaws. In order to work satisfactorily the interior of the solid mold must be perfectly sound; otherwise the rod will not come out. The life of a mold is not long, and if much machine work is required, the cost of molds in the brass mill becomes quite an item. A feasible method of producing a solid mold seems to be to cast iron around a seamless tube which may now be obtained in any thickness. No boring will then be required.—*Editor.*]

WILLIAM WALLACE.

The death of William Wallace occurred at Washington on May 21., Mr. Wallace was one of the pioneers in the brass and copper industry in the United States, and he saw the growth of the industry in the Naugatuck valley from a mere beginning to the magnitude which now exists. William Wallace was born in England in 1825, and with his father, Thomas Wallace, Sr., he migrated at an early age to the United States. The senior Wallace was a wire drawer, and established himself at Derby, Conn., where the first brass wire ever made in this country was manufactured by him and his sons. It is a noteworthy fact that Thomas Wallace, Sr., was the inventor of the process of making brass wire by continuously slitting a tube, and that he was allowed a patent for it in 1837. This process has now been resurrected, and is being used for the production of brass wire.

William Wallace worked with his father, and when the later removed to Ansonia he went with him, and the foundation of the firm of Wallace & Sons was made. This company afterwards became one of the leading brass and copper rolling mills in the United States. Thomas Wallace, of the Wallace Wire Co., of Elizabethport, N. J., is a brother of the late William Wallace, and was associated with him until the company retired from business.

William Wallace early directed his attention to the study of electricity, and associated with him was Professor Moses G. Farmer. These two men brought out the first successful arc light dynamo ever produced in the United States. They were also the first to make compound telegraph wire or a steel core coated with copper.

Since the retirement of the firm of Wallace & Sons from business Mr. Wallace had resided at Washington.

An alloy of 6 parts of aluminum, 1 part of zinc, and 2 parts of Babbitt metal has been patented by Stephen Kneppel, of Scranton, Pa. He says that his alloy is particularly applicable for use in beer vats, coolers, kegs, and pipes, and that the beer does not corrode it.

ALUMINUM BRONZE BEARINGS NOT SATISFACTORY.

In view of the fact that there have been several statements recently in regard to the value of aluminum bronze for bearings it is deemed advisable to make a few statements about the application of this alloy for the purpose. Those who advocate the use of aluminum bronze for bearings must have had little experience in this line, for it has now been thoroughly demonstrated both theoretically and practically beyond a shadow of doubt that a large lead content is necessary to obtain the best results in a bearing metal. This fact is now so firmly established that further comment on it is unnecessary.

As regards the aluminum bronze, it may be said that the nature of the alloy is such that, theoretically, it is unsuited for bearing purposes and experience has borne it out. Some time ago the master mechanic of one of the largest railroads was desirous of trying some aluminum bronze bearings, and he obtained a set for a locomotive. The bearings were put on the most severe place—the driving axles—and the locomotive started out on an accommodation train, making average speed. The remainder of the story is best told in the language of the master mechanic, viz.: "The two aluminum bronze driving boxes which you recently furnished us have proven very unsatisfactory, and we have been compelled to take them out of service. They both ran warm from the start, and, upon removing them after the locomotive had been in service only a couple of days, on local trains, it was found that they were entirely ruined—the metal having run into the oil holes and entirely obliterated them. The metal also spread over the surface of the journals and covered them with a coating of bronze, which was as firmly attached to the surface as if brazed on."

WACHWITZ METAL.

A compound metal under this name has been sold on the European market for some time and is the invention of Heinrich Wachwitz, of Hersbruck, Germany. The material consists of steel coated on one or both sides with aluminum. The sheets are rolled after being coated and may be stamped or drawn and are, therefore, possessed of the character of steel with the properties of aluminum. The method which Mr. Wachwitz employs for the production of these sheets is as follows:

A sheet of metal or any metal coated with aluminum is cleaned on its aluminum side and placed on a steel sheet already cleaned. The two are fastened together so that they will not move and the whole heated in a furnace to the welding temperature of aluminum when the aluminum adheres to the steel. Care has to be taken that the heat is not too high, as the steel will then oxidize considerably and prevent the adherence of the aluminum. The steel just becomes blue if the method is properly done. The metal is now rolled or "broken down" and the aluminum adheres sufficiently for the purpose, holding the two sheets together. The sheet is now returned to another furnace and heated to the welding point of aluminum and further rolled. The sheets will now adhere perfectly and a compound sheet of metal be produced. The process is very simple and seems to be based on the fact that aluminum reduces the thin film of oxide of iron which forms and so renders adhesion possible.

It is stated that within a year the Boston Edison Electric Illuminating Company have purchased 298,245 lbs. of aluminum wire.

THE ELECTRO-WELDING OF ALUMINUM.

BY SHERARD COWPER-COLES.*

Soldered aluminum joints have proved unsatisfactory—they will not stand the test of time, as galvanic action takes place between the aluminum and the solder, which of necessity is composed of metals that are electro-negative to aluminum in a voltaic couple. Another difficulty experienced is the complete removal of the film of oxide from the surface of the aluminum to insure the proper

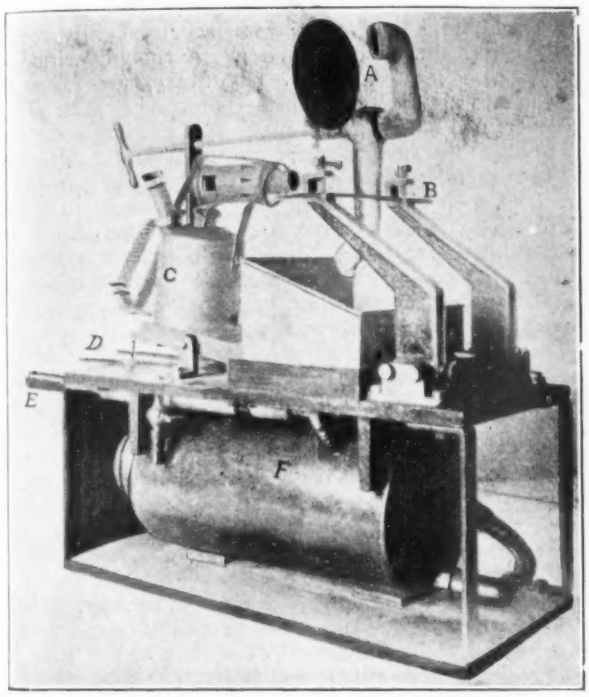


FIG. 1—COWPER-COLES MACHINE FOR WELDING ALUMINUM.

adhesion of the solder. The most serious difficulty encountered when welding aluminum is that, at a few degrees under its melting point, aluminum passes into a brittle or mushy state, and being a very good conductor of heat, the solder rapidly cools and freezes before flowing sufficiently. This pasty state has been made use of by Granger for taking small samples when required, from large pieces of the metal. The ingot is heated in a gas fired muffle to a dark red heat, and strips are then cut from it with a knife, gentle pressure being quite sufficient. If very small quantities are taken, the hot metal may be reduced to powder like zinc, but larger masses are apt to cohere under the pestle. The best welding temperature

FIG. 2—JOINT AFTER WELDING.

lies just below the point where this pastiness occurs. Spring has found that when carefully cleaned aluminum is pressed together and heated to 788 degrees F. after eight hours considerable welding takes place.

Wiszniewska and Strzelecki have proposed to weld aluminum or its alloys by heating the metal to about 1102 degrees F. in a non-oxidizing manner. For instance, by a heated plate and in contact with volatile compounds with an affinity for aluminum, say fluoride or nitrate of aluminum, in a powder or solution.

Cowper-Coles Process.—The author has worked out a process for welding aluminum in which no flux or solder is used, and which does not necessitate the hammer of the joint when in a semi-fluid state.

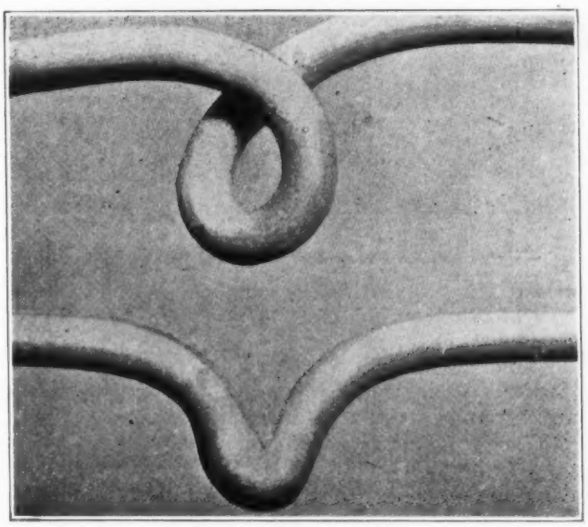


FIG. 3—JOINTS AFTER REMOVAL OF COLLAR AND TESTED BY BENDING.

The process is especially suitable for wire, rods and tubes, and other drawn or rolled sections and consists in placing the parts to be welded, after being faced off square, in a machine illustrated in Fig. 1 fitted with clamping screws which are capable of moving horizontally on suitable guides; the movement of the clamping screws is controlled by the levers D. The aluminum to be welded is heated by means of an ordinary benzine lamp, and as soon as the rods have arrived at the necessary

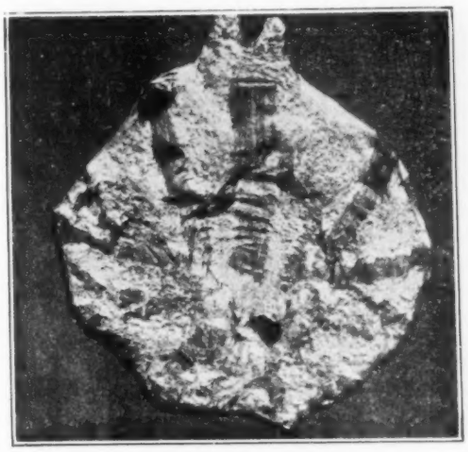


FIG. 4—FUSED ALUMINUM, SHOWING FRACTURED OXIDE SHELL.

temperature, slight pressure is applied to the levers D which causes them to unite, and a ring of metal is squeezed out as shown in illustration No. 2. This ring of metal is largely composed of aluminum oxide and acts as an insulating and supporting collar, the molten metal

*A paper read before the Farady Society December, 1903.

being retained within this collar. The weld is then instantaneously quenched by turning a handle attached to the screen A, which allows water under pressure to be projected on the joint from the reservoir F. The same handle H, which turns the water on places a screen A in front of the heating flame the water pressure is maintained by air supplied by the hand pump F. The rod is then removed from the machine and the collars filed off, when it will be found that the joint is as strong as the rest of the metal.

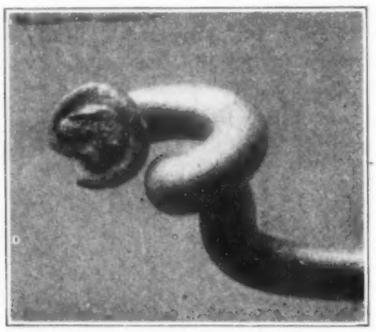


FIG. 5—WELDED ROD TWISTED TO DESTRUCTION.

An oxy-hydrogen flame or ordinary gas, with or without air, can be substituted for the benzine lamp. The process is a simple one and can be worked by any unskilled workman.

SILVER DEPOSIT WORK.

A new form of art work has recently made its appearance upon the market and is called "Silver Deposit Work." The work is in the form of glass articles upon which beautiful designs in silver are deposited. These designs in silver are apparently fastened very strongly to the glass, and have every appearance of having been melted on. The glass and silver seem to be of one piece. The method of doing this has perplexed many, and the method of performing it is desired.

The work is not produced by melting the silver on the glass, as this would not only crack the glass, but would scarcely adhere. The deposit is actually an electro-deposit, but as metals cannot be directly deposited upon glass by means of electro-deposition, on account of the non-conducting surface, some means must be employed to render it a conductor. Plumbago and metallic powders are useless, as they are not only difficult to apply, but could they be used for the purpose the finely divided particles would prevent a perfect adhesion of the metal to the glass. Other means are therefore necessary, and the silver must be put on in a perfectly adherent condition, otherwise the deposit will peel or flake off.

The beginning is made by first silvering the entire surface of the glass by chemical means. This process is quite simple, and is carried out as follows, viz.:

Make up the following solution:

Solution A— { Nitrate of silver crystals.....90 grains
Distilled water..... 4 ounces

Solution B— { Potash (pure)..... 1 ounce
Distilled water.....25 ounces

Solution C— { Milk sugar.....½ ounce
Distilled water..... 5 ounces

Solutions A and B will keep for any length of time, but C must be freshly made. To prepare the solution pour 2 ounces of A into a glass vessel capable of holding at least 35 ounces. Now, add aqua ammonia solution drop by drop, stirring with a glass rod, until the precipitate which is formed is dissolved. Now add 4 ounces of B. This will give a brown precipitate which must be dissolved by the addition of more ammonia as before. Now add water until the bulk reaches 15 ounces, and next, drop by drop, some of solution A until a gray precipitate is formed which does not dissolve in three minutes. Now add 15 ounces more of distilled water, and set aside to settle. Do not attempt to filter, as the paper or cotton used will destroy the value of it.

The glass to be silvered should be *chemically* clean, and it is better if the surface is slightly rough, as the silver then adheres better. A rubbing with very fine pumice may be used, but great care is necessary not to abrade the surface appreciably. The silver, however, will adhere to a smooth surface, and some prefer to allow the surface to remain untouched. After this has been done, give the glass a potash bath for a few minutes and then after rinsing dip momentarily in strong nitric acid and then rinse, first in common water and lastly in distilled water. The glass should not be touched with the hands, and even more care is required in this respect than in the production of plated work as the least contamination will spoil the result.

The glass is now ready for the silvering. Add two ounces of solution C to the clear solution finally obtained above and immerse the article in the solution and it will be found that within a short time a good coat of silver will be obtained all over the glass. Of course no electric current is required for this. Do not leave too long in this bath, as a thick coating is not desirable. When nicely covered with an even coating of silver, nothing more is needed, except to rinse off in cold water and, lastly, in cold distilled water. The work must not be touched with the hands, but should now go directly to the usual cyanide bath and the required deposit of silver put on. This process is now simple, for the entire surface of the glass has been covered with silver, which renders it an excellent conductor, and any amount of silver may be put on by the electro-deposition process.

After the required amount of silver has been put on, the work is removed from the bath, washed, dried, and the desired design traced out on the surface and the portions not within it cut away. The silver will be found to adhere to the glass very tenaciously.

If the above solution is found to be troublesome to make up, the following may be substituted:

Solution A— { Distilled water..... 8 ounces
Nitrate of silver..... 1 ounce

Pour into a rapidly boiling solution of Rochelle salts, 1 ounce dissolved in 10 ounces of water. Cool and allow precipitate to settle.

Solution B— { Distilled water..... 8 ounces
Nitrate of silver..... 1 ounce

Add ammonia to the solution until the precipitate formed is nearly dissolved. Now add distilled water until the volume is 96 ounces. To silver the glass, equal parts of A and B are mixed.

United States Consul Warner, of Leipzig, Germany, writes to the Department of Commerce and Labor that a number of Wiesbaden capitalists, together with the Rheinischen Fabrik in Hönningen on the Rhine, are about to establish a nickel works at Hönningen. They propose to import quartz containing nickel from foreign countries (probably from Mexico) via Rotterdam, and up the Rhine River in barges, and, by means of a chemical process, to extract the nickel.

ORMOLU GOLD FINISH.

By F. P. Davis.

The ormolu gold finish is now being put upon a large variety of articles, and forms a very pleasing finish, and one which, for its lasting qualities, is quite superior to the average finish put upon art goods. The ormolu finish put upon articles to-day consists of a matt surface of a bright gold color. The surface is really gold, and is usually lacquered as such a treatment preserves the lasting qualities. The ormolu finish is found on clocks, statuettes, vases and a similar variety of art goods, and may be put on any kind of material, brass, spelter, bronze, britannia metal, or even iron. Spelter, however, forms the principal base upon which it is put, as this metal is cheap, and may be cast in metal molds to the desired form.

I am unable to find the derivation of the word "Ormolu," but it is apparently derived from the French, as the articles first made their apearance in that country. The early examples of ormolu finished goods did not consist of the same material used to-day, but were made of a certain kind of brass which, when treated, gave the matt surface to be gold plated. This alloy, of which the ormolu goods were made, is supposed to consist of copper 58 parts, zinc 25 parts, and tin 17 parts. This gives a bronze which possesses a golden color. It is quite hard, and when dipped in the proper kinds of dip has a pleasing matt surface. It forms an excellent base for gilding, as the color is almost identical with that of the gold put upon it. By the use of such an alloy, having the required tint for gilding, the coating of gold may be very thin, and, therefore, none need be wasted. As far as I can discover, however, this bronze is not used in the United States at the present time for the production of the ormolu finish, but the method of brass plating has superseded it on account of the great reduction in cost which can be made by so doing. The majority of goods finished with the ormolu finish to-day consist of spelter, brass plated, and then dipped with a matt surface to be afterwards plated with gold.

If we take as an example the ordinary spelter article found in commerce with the ormolu finish the production of the finish will consist of several stages, viz.:

1. The casting of the spelter article.
2. The production of a polished surface.
3. The brass plating of the article.
4. The dipping to produce the matt surface.
5. Gilding the article.
6. Lacquering.

The spelter article is first buffed with any suitable material and a fine surface brought upon it. A good brass plate is then put on so that the color of the deposit will be as near that of fine gold as it is possible to make it. The production of this brass plate requires much care and attention to details. As the method of brass plating has already been described in THE METAL INDUSTRY it is harly necessary to go into details about it. An even coating of a good thickness is necessary for the proper attainment of the end.

When the article has been plated with the brass it goes directly into the matt dip, and herein lies the real secret of the whole operation. If a good matt surface is not obtained the process will not be a success. This matt dip is unlike the usual bright dip, and is used in conjunction with the latter. The principle of the dip is that it has been saturated with zinc and the action is then mainly on the copper in the brass, leaving the surface with very fine matt. The matt dip is made from aqua fortis (nitric acid) and sulphuric acid, usually equal parts. Some saturate the nitric acid with zinc before it is added to the sulphuric acid, while others add sufficient quantity of sulphate of zinc directly to the mixed acids. Additions of common salt or muriatic acid will vary the depth of the matted surface. The following is an excellent matt dip, and one which has been used for many years with excellent results:

Yellow aqua fortis	200 parts
Sulphuric acid	100 parts
Common salt	1 part
Sulphate of zinc	1 to 5 parts

Another dip is made as follows, viz.:

Nitric acid	1 pint
Sulphuric acid	1 pint
Sulphate of zinc	10 ounces

Both of these baths need to be stirred well before using, as the sulphate of zinc will settle to the bottom of the stone crock unless this is done.

These dips are used hot, and are used in stone pots surrounded with hot water. The article should be thoroughly cleaned. If small work is to be treated which has to be strung on wires care should be taken that they do not touch; otherwise, streaks will result.

To use the dip the article or articles should be plunged into it immediately after stirring and allowed to remain until the action ceases. The ceasing of the action is known by the absence of bubbling. The article should be held still in the bath and not be moved about as it is in the usual dip. Upon removing from the dip the article should present a dark and dirty appearance, but even and smooth nevertheless.

The article must now be rinsed very quickly as the matt surface carries a lot of acid, and unless quickly rinsed more or less action will take place and ruin the work. This rinsing should be quickly and thoroughly done. After rinsing, the color is brought out by the usual bright dip. This dip must be kept up to strength and bite sharp and clear, as it will rapidly deteriorate under this class of work. This dip is made in the usual manner, and may be composed of the following:

Yellow aqua fortis	5 gallons
Oil of vitriol	5 gallons
Common salt	2 handfuls

The dip should be kept cold, and to keep it so the stone crock is placed in running water.

After the work has been treated with the bright dip it is rinsed thoroughly and dried, but great care is necessary to avoid abrasion. The matt surface produced is quite susceptible to rough treatment that ordinary work is given, and any scratches or similar abrasion will render the work unsightly. It is better, therefore, to dry the work in alcohol if the fine finish is desired.

Of course, if the work goes to the gold bath the drying is superfluous, but there is much work which is not gold-plated but simply lacquered and allowed to go. The drying then becomes a serious problem, especially on large work made of soft metals.

Theoretically a matt dip of the kind given will not matt red brass, but I have seen commercial sheet copper nicely matted in such a dip to which had been

added a small quantity of hydrofluoric acid. The amount of this acid to be used must be small, otherwise the stone crack will be acted upon.

A small quantity of white arsenic say, one or two ounces to five or six gallons of dip, will produce a remarkably fine matt which will have the sparkling appearance so much desired. The dull, heavy look so often found will be absent if the arsenic is used. This method is especially adapted to brass clock dials and movements which are visible. The finest work of this kind I have ever seen was produced by these two methods, and in each instance the workman was illiterate, not to say ignorant, and knew nothing of the theory which goes to prove that in his particular case practice was the more valuable of the two.

Spelter and iron work are frequently sand blasted before plating. The brass plating bath must be rich in metal to give the matted surface to the highest degree.

When the article has been put through the bright dip and rinsed thoroughly it is ready for the gilding, and no time should be lost in transferring it, as oxidation is liable to take place if expedition is not used. The gold bath should be made so that the plate deposited upon the article is of nearly the same color as the base metal. The nearer the two match the more perfect the job.

The gold bath is regulated by the color desired, but the reddish tint is usually desirable, and may be produced by the addition of a small amount of cyanide of copper to the gold solution and running it hot. If the straw-colored tint is desired the color may be formed by adding cyanide of silver to the bath and running cold. The gold bath is made in the usual manner, and consists of oxide of gold dissolved in cyanide. What tint to obtain is left to the operator, but no difficulty should be experienced in this part if a good matt surface has been obtained.

The amount of gold put on need not be large; indeed, all that the gold does is to protect the matt surface from oxidation, and the cheapness at which articles are now sold indicates that there cannot be much gold wasted. The operator need only deposit an even coat of gold, and that is all which is required.

After the gold has been put on, the articles are dried in alcohol to avoid abrasion and given a good coat of suitable lacquer to further protect the surface.

OXIDIZING ZINC.

The increasing use of zinc for many purposes makes it desirable to produce various finishes on it. A good black finish may be prepared in the following manner: The zinc is cleaned from grease or oil and plunged into a bath composed of water 32 parts, butter of antimony, 1 part, and chloride of copper 2 parts. After the desired effect has been produced, the zinc is washed and dried, when it will be found that a permanent black deposit has been formed. The zinc may now be given a thin coat of white lacquer, if a permanent character to the entire work is desired.

The butter of antimony (chloride of antimony) may be used alone, if desired, but the deposit formed is not quite so permanent as that produced by the copper and antimony together.

Good effects may be produced by first giving the zinc an ornamental design with some suitable varnish or ink and then oxidizing the portions uncovered. The varnish may then be removed by alcohol, benzine, or other solvent and the whole covered with lacquer. The design will now stand out in bold relief.

PLATING WATCH CASES WITH GOLD-NICKEL ALLOY.

A solution containing both nickel and gold salts is now used to a considerable extent for plating watch cases. The results obtained are the production of a harder plate than that formed for a gold and silver solution, and the fact that a cheaper mixture may be used for the formation of work of a given carat color. This method is used by many watch case factories, and gives a hard deposit with a good color.

The solution may be made by dissolving carbonate of nickel in cyanide of potash and adding to the gold solution. As the nickel requires a strong current and gold a weak one much care is necessary in obtaining the required conditions. The anode is made of an alloy of nickel and gold; 100 parts of gold and 30 parts of nickel. The two are melted together under borax and poured out into a mold. The cast anode will have to be used as it is, as this alloy cannot be rolled into sheet.

WELDING LEAD.

It has been shown that all metals may be welded in the cold if the two surfaces are perfectly clean and a heavy pressure applied which is proportionate to hardness of the metal to be welded. As the pressure necessary for welding the hard metals is necessarily very great the process is not commercially successful. Soft metals may be welded in this manner much more easily than hard.

A simple method of welding lead is by the use of lead amalgam. This amalgam may be made by dissolving lead in mercury until the mass is thick. The lead surfaces to be welded are carefully cleaned, and the amalgam spread over them. By passing a hot soldering iron over the line of junction the mercury is volatilized and the lead is set free in a finely divided condition so that a joint is made.

VERDE ANTIQUE OR GREEN BRONZE.

This finish may be put upon bronze in the following manner, viz.: Mix well 10 parts of acetic acid, 30 parts of sal ammoniac, 10 parts of common salt, 10 parts of cream tartar, 10 parts of acetate of copper. Make into a paste with water and smear the clean bronze with it. Allow to stand for 24 to 48 hours, and the article will be found to be covered with the green verdigris desired.

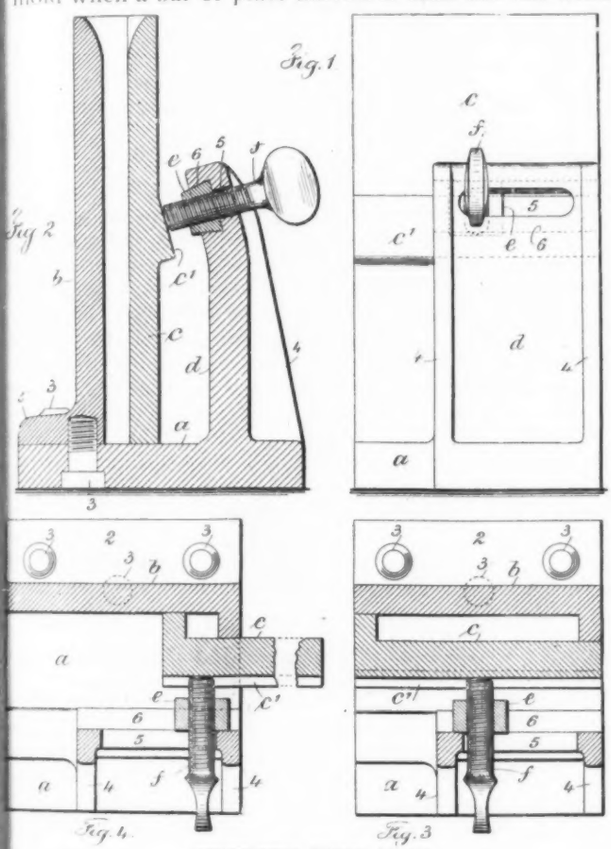
The exposed parts of the article are brushed off after the article has been washed and dried, and the surface given a coat of lacquer. The length of time that the paste stays on the article determines the depth of color. The best results are obtained on real bronze.

Boracic acid is far superior to borax for a flux in brazing. Borax melts down to a hard glassy slag which requires a prolonged soaking in boiling water to remove. Boracic acid does not do this and the fused mass is easily soluble in hot water. The time in cleaning brazed work, therefore, is much lessened in the use of boracic acid. It is extensively used for this purpose.

Anodes made of rolled metals are far superior to the cast article. A casting is not homogeneous and dissolves away very unevenly leaving detached parts to fall into the solution. A good rolled anode will dissolve away so evenly that the merest film may remain in the solution without danger of parts becoming detached.

A NEW FORM OF JEWELER'S INGOT MOLD.

A new form of ingot mold for use in casting small amounts of gold, silver or other metals has been brought out by Charles A. Leibman, of E. P. Reichhelm & Co., of New York. This mold has several unique features. In appearance it is like the usual jeweler's mold and consists of two parts. A section of the mold is shown in Fig. 2, while in Fig. 1 is seen the front of the mold. The side of the mold *b* is made stationary and is a part of the base, but the other half *c* is made adjustable so that bars of varying width may be cast. This feature, of course, is not new, but ordinarily it has been difficult to properly clamp the mold when a bar or plate narrower than the full width



JEWELER'S INGOT MOLD.

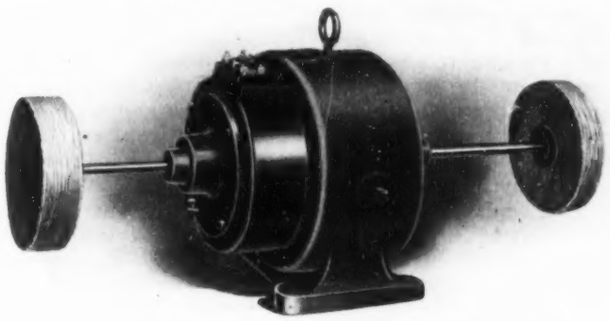
of the mold was desired. In this mold, however, the thumbscrew, which is used to clamp the mold together, is allowed to slide in a groove so that it always adjusts itself, no matter what the width of plate is desired. Such a feature always insures a tightly clamped mold and the gold or silver will not run out, as it often does in the old form of mold. Another excellent feature of this mold is the fact that the clamping thumbscrew is placed on a slant, so that the tendency is to push the loose half of the mold down tightly on the bottom of the base plate and prevent the loss of metal or the formation of fins.

An alloy of 6 parts of gold and 1 part of iron is known as grey gold. When the amount of iron is increased to one-third of that of the gold or 3 parts of gold and 1 of iron the mixture becomes known as blue gold. These alloys may, with care, be rolled into sheet and are used for jewelers' work when certain tints are desired. An alloy of 5 parts of gold and 1 part of copper is known as brown gold.

POLISHING AND GRINDING MOTORS.

There is scarcely a tool around the shop which gets out of order as quickly as the grinding or buffing lathe. The belt is always too slack or the boxes so worn that the machine rattles like a lumber wagon, or the countershaft does not work well, or there are not sufficient steps to the cone to obtain the various speeds required. Taking it as a whole this tool needs about as much watching as any in order to obtain good work on it. Not but what good work may be obtained on it, but, like all tools of this kind, it can be improved.

It needs no argument to show the adaptability of the motor for the purpose of grinding or buffing, and when properly arranged or set up there is no better appliance or one which will give more satisfaction. The speed at which a motor will run, the ease with which it is driven, and the fact that no belts are



necessary render the motor the ideal machine for this purpose.

The Connecticut Dynamo & Motor Company, of 526 West 25th street, New York City, are putting on the market a line of motor driven polishing and grinding tools. In these, the shaft is lengthened so as to give ample space for the wheels. The motors are well enclosed so that dust cannot penetrate. For those who only occasionally do polishing these motors will answer admirably, as they may be started instantly and any desired speed obtained. As there are no countershafts a shop may be driven with one-third less power where these grinders are used. We herewith illustrate one of these polishing and grinding motors.

MADE IN GERMANY.

The fact that the new bronze statue of Queen Victoria, recently erected in an English town, was discovered to have been made in Germany has caused all sorts of unfavorable comments in the various trade papers of England. The insular pride has been touched. After much criticism in regard to it, someone took the trouble to investigate, and found that instead of being made in Germany the statue was actually cast in Belgium. The public then seemed to feel relieved, but one investigator quizzed the artist about it, who said that his reason for having the statue cast in Belgium was the fact that his experience had taught him that the finest bronze castings are produced by this particular Belgium firm. The disgruntled party says that there would have been as great saving in expense had the statue been cast in England, but the point which grieves him most is not the fact that foreigners can do work cheaper than the English, but that they have facilities for producing certain kinds of artistic work which the Britons cannot make.

CORRESPONDENCE DEPARTMENT

In this Department we will answer any question relating to the non-ferrous metals and alloys. Address THE METAL INDUSTRY, 61 Beekman St., New York

Q.—A subscriber wishes a method of combining iron with brass so that the resulting alloy will not turn black on the surface when cast in sand. He says that he has tried iron wire, cast iron turnings, iron emery grindings, but without success.

A.—The most satisfactory method of adding iron to brass is to introduce it in the form of ferro-manganese. The manganese enables the iron to alloy well with the brass. The amount of manganese in the ferro-manganese need not be great, and it will then practically all oxidize out in the melting, leaving the iron perfectly alloyed. To carry out this method purchase some 80 per cent. ferro-manganese, such as the steel companies use, and which contains about 80 per cent. of manganese and the rest iron. Melt 1 part of this with 3 parts of wrought iron (cut into small pieces) in a crucible, and pour into small ingots. The ferro-manganese will enable the iron to melt readily, and the ingots obtained will be brittle, and can be broken to obtain the required weight. To alloy with the brass, melt this product with the copper in the crucible, and when thoroughly mixed add the zinc and other metals desired. The bright surface which you speak of as desirable on sand castings cannot be obtained without the addition of aluminum, and all alloys containing iron and used for sand casting contain this metal. If you wish to make an alloy analogous to Delta metal, which you mention, the following proportions may be used: Copper, 56 lbs.; zinc, 41 lbs.; iron alloy above mentioned, 2 lbs.; tin ½ lb.; aluminum, ¼ lb.

Q.—A foreign correspondent wishes to know the method of rolling aluminum very thin.

A.—Aluminum is rolled to very thin gauges in the same manner as gold, silver, brass or copper is done. The metal, of course, should be of the utmost purity, so that it will stand the necessary reduction. The rolling is conducted on chilled rolls in the usual way, and rolled as thin as possible. The sheet is then slit so that each strip is not over 4 inches wide and preferably less. If the sheet is rolled wider the requisite "pinch" cannot be taken without springing the rolls. The rolling is now conducted on hardened steel rolls, polished and ground perfectly flat—that is, without any crown on them. The sheet, of course, is annealed before this rolling begins. Great care is required in order to prevent the thin sheet from tearing, and an operative reels the sheet behind the rolls as fast as it comes through. The "pinch" of the rolls is adjusted by the operator as required. By this method the sheet may be rolled to 0.0005 inch in thickness. This is about the limit of thin rolling in a single thickness, and if thinner sheet is desired it will have to be rolled in packs. In order to prevent adherence of the sheets soapsuds are injected on them before rolling. In rolling thin sheet the metal must be "bridled" before going through the rolls—that is, producing a reluctance of the sheet to go through by straining it, as by this method a much thinner gauge may be rolled. If you will refer to THE METAL INDUSTRY, October, 1903, you will find the process of rolling tin foil described, which gives all the details necessary for rolling other thin metals.

Q.—A manufacturer of aluminum goods wishes to know how the black finish is put on aluminum.

A.—This finish is nothing more than a lacquer or enamel, and is put on in the same manner. The lacquers for this purpose may be obtained so that they may be either baked or put on like an ordinary lacquer. The baking enamels or japans give the most lasting results. As these preparations are best purchased we recommend that you write to the maker and allow him to send you a trial lot.

Q.—The receipt for producing a finish on brass goods known as statuary brown is desired. The color desired is a chocolate brown.

A.—This brown finish is known as bronze barbedienne, and is produced in the following manner, viz.: 1 part of white arsenic and 1 part of tartar emetic are dissolved in the smallest possible amount of potash solution. Warming hastens the action. Now add a solution of tartaric acid until the solution is just neutral to test paper—that is, neither the acid or alkali predominates. Now add a solution of ammonium sulphide until the reddish yellow precipitate formed just barely disolves. The solution is used warm, and the brass immersed in it and the color watched. At first the color will be golden yellow and the brown tint appears. Remove the article from the bath and scratch brush. Now return to the bath and the real color will be brought out. The solution must be fresh to work well. It may, however, be renewed by the addition of ammonium sulphide.

Q.—A plater says that he has tried all kinds of solutions for blackening brass, and that all of them leave something to be desired. The carbonate of copper and ammonia gives a good black, but fades in a short time even when lacquered. He believes that the black produced by the action of liver of sulphur on copper is the most satisfactory of them all, but this does not give all that he wants. He says that he has tried acetate of lead and hyposulphite of soda, arsenic and muriatic acid and the two solutions first mentioned.

A.—All that seems to be left in the blackening line that you have not tried is a weak solution of chloride of platinum. This will give a very permanent black of an excellent color, but, of course, its cost precludes its use except in instances where the price will warrant.

Q.—Plater asks if there is anything besides arsenic which can be added to a brass plating solution in order to obtain a bright deposit. He says that he has not been able to obtain the required brightness by its use.

A.—Arsenic seems to be the only thing for the purpose, and if well used, the results will be good. Perhaps you add too much. An excess produces a dull grayish deposit. If your baths are in good working order the small amount of arsenic mentioned in article on brass plating in THE METAL INDUSTRY, April, 1904, will give you what you wish (in which the whole process of brass plating is described).

Q.—A foundryman desires to have us enlighten him on the following questions, viz.:

1. What is the best brass alloy for sand castings to be used on automatic machines. This alloy should turn freely?

2. What is the best method of using the yellow brass chips, turnings, sheet scrap, etc., found on the market?

A.—The best yellow brass mixture, as well as the cheapest that will give good castings, is made as follows, viz.:

Copper	10 lbs.
Zinc	4 lbs.
Lead	5 ounces
Tin	3 ounces

This will give an excellent alloy, and one which will cut freely. If not stiff enough add more tin, but this will harden it so that it will not cut as well.

The best method of using yellow brass scrap such as chips, etc., is to melt them down and run into ingots. If run into castings the result is not good. By remelting the ingot good castings may be secured. If the chips are from screw rod it will not be safe to add any more lead. The difficulty in the use of scrap is that it is impossible to tell what the mixture is. Otherwise there is no difficulty in its use. If the castings made from the scrap do not cut freely add more lead. Add about 2 lbs. spelter to 100 lbs. of metal every time the melting is made to compensate for the loss.

Q.—A subscriber wishes to know how to mold sealing wax.

A.—This is somewhat out of the metal line, but for his information we will say that by the use of a brass mold and coating the inside with mercury the adherence of the wax to the mold may be avoided.

ST. LOUIS FOUNDRY EXHIBIT.

We have received from Mr. J. A. Holmes, Chief of the Department of Mines and Metallurgy, of the World's Fair, at St. Louis, a plan of the foundry building. The idea of the building is to show a model foundry in operation, and to enable foundrymen to have a building of their own. The plan indicates that the building fulfils this purpose. It is sub-divided into a foundry headquarters, a foundry for heavy work, another for light work, a brass foundry, core room, blower room, room for tumblers, cleaning room, etc. It is to be equipped with the machinery for a working foundry, and castings will be made in iron, steel, brass, bronze, aluminum, etc. Some of the castings will be of such a size and character that they may be sold to visitors.

Clarke Merchant, president of the metal house of Merchant & Co., Incorporated, Philadelphia, Pa., died at his home in that city on May 7 after a brief illness. The cause of his death was pneumonia. Mr. Merchant was 67 years old, and was one of the pioneers in the tin plate business in the United States. He was a member of the Philadelphia Club, the Union League and the Loyal Legion, and was prominent in the business community. He was a graduate of the United States Naval Academy, and in the Civil War served with distinction in the navy, rising to the rank of Lieutenant-Commander.

CONVENTION OF AMERICAN FOUNDRYMEN.

The American Foundrymen's Association has issued the provisional programme for the Indianapolis Convention of June 7, 8 and 9, and which is to be continued at St. Louis that the foundrymen may have an opportunity to visit the World's Fair. Certificate rates of fare and one-third for the round trip to Indianapolis, Ind., have been obtained, and the railroads have made the dates of the convention read from the 7th to the 16th of June, which will give the members plenty of time both at Indianapolis and St. Louis. The first day's session of the convention will be taken up by the addresses of State and city officials, and reports of the various committees. In the evening a number of papers will be presented. The second and third days will be devoted to business and the reading of papers, of which there are a number on timely topics. There will also be a number of discussions on interesting subjects. At the end of the third day the association will adjourn to St. Louis, and the arrangements for visiting the Fair and the Fair City will be announced at the Indianapolis Convention, where the headquarters will be the Hotel Claypool.

It is rarely that a metal controversy gets into the police courts unless it is a case of pilfering, but a complaint was recently lodged in the Tenderloin police court of New York City by one Edward Temple against James K. Fisher for swindling him out of $4,500. Temple stated that he was induced by Fisher to put up this money for the exploitation of a process for "tempering copper." He said that he had discovered the "long lost art."

ROSS-TACONY CRUCIBLES.

The Ross-Tacony Crucible Company have at Tacony, a suburb of Philadelphia, one of the most modern crucible plants in the country, and their business has increased to such an extent within the last few years that the company expects in the near future to build an addition to their present works, having about an acre of ground for this purpose. The firm of Ross & Co. was established in 1870 at Philadelphia. In 1902 they bought the entire stock of the Tacony Crucible Company and formed a new corporation under the name of the Ross-Tacony Crucible Company, moving their works to Tacony. A year later they found their plant too small for their increasing business and doubled the amount of their floor space to a total area of 40,000 square feet. The Ross crucibles are shipped to every State in the Union and to a number of countries abroad. The company manufacture crucibles for brass and steel works, also stopper-heads, nozzles and lubricating plumbago.

CARBORUNDUM AT ST. LOUIS.

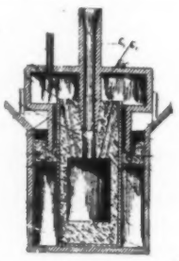
The Carborundum Company, of Niagara Falls, N. Y., has just shipped two freight cars loaded with products to be displayed at the St. Louis Exposition. The exhibit will occupy Block No. 16 in the Machinery Building, and will be one of the most elaborate ever made by the Carborundum Company.

One of the principal features will be a great pyramid of Carborundum crystals, seven feet high and six feet in diameter at the base. The crystals are of the most beautiful shapes and colors, and will produce a really dazzling effect when properly lighted. The balance of the exhibit will be made up of Carborundum wheels, sharpening stones, fire sand and other products; also samples of different work that has been made possible by the use of Carborundum. The exxhibit will be in charge of William H. Arison and E. W. Taylor.

PATENTS

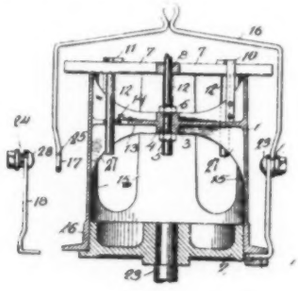
A full copy of any Patent mentioned will be furnished for Ten Cents. Address THE METAL INDUSTRY, 61 Beekman Street, New York

755,842, March 29, 1904. APPARATUS FOR CASTING METALS IN VACUUMS.—Walter B. Burrow, Norfolk, Va. A vacuum casting apparatus, the combination of a metallic outer drag, box or case, a flange or lip projecting outward forming a flared rim at the top of the said drag, a detachable cope, bonnet or top over and entirely enclosing the mold in its flask or box, the said outer



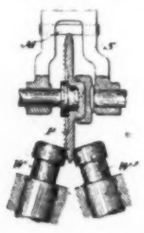
cope or top fitting into a space on a sand filling around and between the inner mold-flask and the outer drag or box, and a metallic seal at the junction of the outer cope or top and the outer drag or box, of a lower melting-point than the said top part or cope and the lower part or drag, as described.

756,003, March 29, 1904. WIRE-DRAWING APPARATUS. William D. De Lamarter, Elizabeth, N. J., and James A. Macdonald, Flushing, N. Y., assignors to Waclark Wire Company, New York, N. Y., a corporation of New Jersey. In wire-drawing apparatus, a driving-shaft, a drum having peripheral recesses mounted thereon, a reel having a continuous winding-rim re-



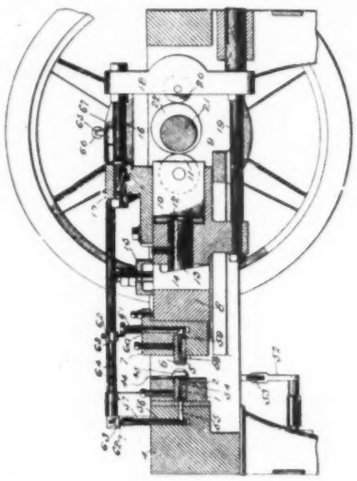
movably engaging said drum and having driving-lugs engaging said recesses, an axial stud mounted on said reel, hooked retainers on said reel, a reel-head having arms releasably engaging said retainers and having a stud-hole to be engaged by said stud, guides on said head, detachable trunnion bars having trunnions thereon engaging trunnion-sockets in said reel and a yoke to engage said trunnions to invert said reel.

756,404, April 5, 1904. METHOD OF MAKING HOLLOW METAL ARTICLES. Eugen Polte, Madgeburg-Sudenburg, Germany. The



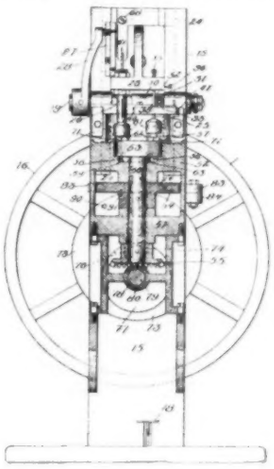
method of making hollow metal articles, which consists in rolling a disk of metal spirally from the center toward the periphery while maintaining its flatness, and then forming it into the desired shape.

756,212, April 12, 1904. MACHINE FOR FORMING BALLS. Andrew C. Campbell, Waterbury, Conn., assignor to the E. J. Manville Machine Company, Waterbury, Conn., a corporation of Connecticut. A machine for forming balls having a frame, a cutter, a holder, means for moving the holder and cutter toward each other and against opposite sides of the piece to be cut, means for moving the cutter and holder together and causing a piece to be cut and carried between them into line with a die fixed with relation to the frame and a die movable with relation to the frame, means for reciprocating the movable die and causing that die to first hold, then dwell, and afterward compress into



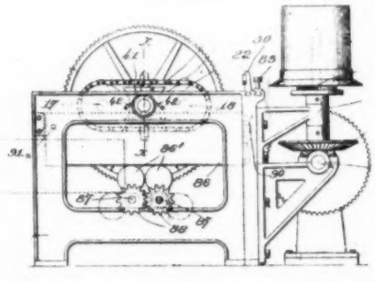
spherical form the cut piece, and means for drawing the holder and cutter apart from between the dies while the movable die dwells, substantially as specified.

756,965, April 12, 1904. MACHINE FOR MANUFACTURING BALLS FROM SHEET METAL. Allen Johnston, Ottumwa, Iowa. In a machine for forming hollow balls, a punch and die for drawing the



flat blank into cup shape, means for removing the blank from the punch a closing-die carrying its own ejector, and a positioning device whereby the cupped blank is positioned for the operation of the closing-die.

757,671, April 19, 1904. WIRE-DRAWING MACHINE. Daniel J. McMahon, Taunton, Mass. In a wire-drawing machine, a frame mounted to turn about its axis and having a plurality of faces



in different planes, a plurality of drawing-drums revolubly mounted in said frame, and drum-rotating mechanism, said frame having means to support a die on each of its faces.

TRADE NEWS

When You Have Any Trade News of Interest Send It to THE METAL INDUSTRY, 61 Beekman Street, New York.

The Rochester Snap Flask Works, of Rochester, N. Y., have issued a catalogue of their snap flasks and bench rammers.

The John Buckley Hub, Spoke and Wheel Company, Philadelphia, Pa., make a specialty of gum wood for metal spinning chucks.

The firm of Samuel Butter & Co., metal dealers, smelters and refiners, are now located in their new smelting plant at South Braintree, Mass.

The Howe Scale Company, of Rutland, Vt., are selling many scales to the Russian Government for use in the commissary service of the army.

The Roe Stephens Manufacturing Company, of Detroit, Mich., have issued Catalogue No. 9 containing a list of their standard brass and iron valves.

The Macungie Brass & Manufacturing Company, Macungie, Pa., report an active trade. They think of putting in additional brass working machinery.

W. D. Berry, organizer and president of the Beaver Valley Metal Company, of New Brighton, Pa., has severed his connections with that company.

The Bevins Bros.' Manufacturing Company, East Hampton, Conn., makers of bells, will put up a two-story brick addition to their plant, 37 x 100 feet.

The Williams Typewriting Company, of Derby, Conn., have finished a new addition to their factory and bought machinery and tools for its equipment.

Paul Grimm, a metal dealer, has moved into the quarters formerly occupied by the Columbia Smelting & Refining Works, at 309 Water street, New York.

The St. Louis Brass Manufacturing Company have secured several good contracts for the World's Fair, one of which calls for 40,000 feet of brass tubing.

The Brass Foundry of Shapiro & Aronson, New York City, are sending out a map of Eastern Asia embracing the seat of the war between Russia and Japan.

A. H. Wells, of Waterbury, Conn., manufacturer of small brass and copper tubing will build a new power house and machine shop 50 x 65 feet, one story high.

John Hamilton, a brass goods manufacturer of Bridgeport, Conn., has for a number of years made plumbers' supplies, and has a large local and out of town trade.

L. Best, 45 Vesey street, New York, sales agent for the Sterling Emery Wheel Manufacturing Company, Tiffin, Ohio, has a stock of 25,000 emery wheels constantly on hand.

"Great Lakes Condensed Facts" is the title of a booklet issued by the Great Lakes Engineering Works, of Detroit, Mich., and which describes the machinery built at the works.

The Ralph Manufacturing Company, of Philadelphia, Pa., manufacture "Imperial" metal polish for use on brass, nickel, gold, silver, bronze, aluminum, tin, copper and zinc.

Fairbanks, Morse & Co., of Chicago, Ill., have issued catalogue 48C, which shows their latest designs of pumps and gives other interesting information for users of pump machinery.

The Thomas Devlin Manufacturing Company, of Philadelphia, Pa., expect to erect a galvanizing plant at Burlington, N. J. They manufacture malleable iron and brass castings.

The Galt Art Metal Company, Limited, Galt, Ontario, Canada, have been incorporated with a capital of $100,000 to manufacture everything in the line of architectural sheet metal goods.

Frank McAllister has leased the Brown Foundry, of Middletown, Conn., where he will do all kinds of jobbing work, particularly ship work, having a variety of patterns for marine castings.

The Comstock-Oberndorf Company have moved to the corner of Penn avenue and Thirty-second street, Pittsburg, Pa., where they have more floor space and better light than in their old quarters.

Joseph Rosenthal's Sons, proprietors of the Keystone Brass Foundry and Smelting Works, Philadelphia, Pa., report an active business both in their smelter and foundry. They are running overtime.

The Pittsburg White Metal Company report that in the two and one-half years of the establishment of their New York Works at 160 Leroy street their business has far exceeded their expectations.

The Consolidated Lead Company have begun to operate their plant at the corner of Avenue D and Fourteenth street, New York City. The works are 50 x 125 feet and thoroughly modern in equipment.

The Union Novelty Works, of Putnam, Conn., whose factory was burned out last April, report that they are making rapid progress in rebuilding and expect to have their new factory in operation by August 1st.

William Durst, a brass manufacturer of 4 Water street, Brooklyn, N. Y., occupies three floors containing 30,000 square feet. His shop is equipped with a 100 h. p. engine and machinery for any kind of brass work.

The Rolled Plate Metal Company are established in their works at 172 Lorimer street, Brooklyn, N. Y., and report a satisfactory business. They manufacture polished copper and zinc plates for the use of engravers.

The Scientific Toy Company, of New Haven, Conn., have been incorporated with a capital stock of $16,000. The company will manufacture patented toys and novelties out of metal, wood, composition, paper, glass and mica.

The Excelsior Brass Works, of Philadelphia, Pa., have extended their plant from 1517 Florist street through to Spring street, giving them 4,000 square feet of space. They manufacture plumbers' supplies and job work.

A number of stockholders are withdrawing from The Smith & Winchester Company, South Windham, Conn., and it is possible that the company may go out of business. There is also a possibility that the company will continue.

The Roberts Chemical Company, Niagara Falls, N. Y., guarantee to electro-platers a saving of over 25 per cent. by the use of their high grade caustic potash. Their potash gives more speed, cleaner work and greater economy.

The Tilghman-Brooksbank Sand Blast Company, 409 Commerce street, Philadelphia, have been appointed sole agents for the sale of all sand blast machinery and supplies manufactured under the Tilghman and Matthewson patents.

An addition to the plant of R. Wallace & Sons, silverware manufacturers of Wallingford, Conn., will be built of brick and steel construction 31 x 70 feet. They will also build onto their office a three-story brick addition 24 feet square.

The McKenna Brothers' Brass Company, of Pittsburg, Pa., have awarded the contract for their new store and office building at Barberton, Ohio. The new building will contain four large storerooms and office quarters, and will be the finest business structure in Barberton.

The Brass Foundry Supply Company, of Newark, N. J., have published a new edition to their catalogue No. 12.

The Hays Manufacturing Company, of Erie, Pa., announce that they are engaged in adding new patterns to their line of plumbers' brass goods.

The Lancaster Sheet Metal Company, Lancaster, Pa., have changed their title to the Sheet Metal & Supply Company, and have increased their capital stock from $25,000 to $100,000. The company do all kinds of sheet brass and copper work and are jobbers in plumbing, steam and mill supplies.

Richards & Co., 60 Union street, Boston, Mass., issue an attractive booklet entitled "Facts About Solder." The manufacture of solder is one of their specialties and their brand is made of 50 parts boustead tin and 50 parts desilverized lead. Richards solder is guaranteed to be ½ and ½.

The Columbia Smelting & Refining Company are now established in their new New York smelting plant at 360 West street, extending through the entire block to Washington street. They have put in several new furnaces and a new smokestack. At their Brooklyn works they are smelting some Alaskan tin ore.

John Toothill, proprietor of a White Metal Rolling Mill, formerly located in Walker street, New York, has fully recovered from the effects of a fire at his old shop and has his mill in operation at 210 Canal street, where he has more roomy quarters. Besides rolling white metals, Mr. Toothill does metal spinning.

The Fisher Governor Company, of Marshalltown, Iowa, are filling orders for the Germany Navy. The governors sent to Germany are made entirely of brass to meet naval requirements. The Fisher Company state that many of their orders for governors come from firms that they have been doing business with for the past fifteen years.

The Enterprise Tool and Metal Works, of Chicago, Ill., have been incorporated with a capital stock of $10,000. The company will do experimental work and make a specialty of gas mantle machines, gasoline lamp and system parts. The officers are: Frank Rosengren, president; Charles W. Nelson, vice-president; F. W. Rosengren, secretary; George T. Rosengren, treasurer.

The Empire Metal Company, of Syracuse, N. Y., report that by using their "Imperial" phosphor tin in place of ordinary tin in making bronze that bronze castings may be doubled in tensile strength. By useing this brand of tin in making brass castings it will make the metal so liquid that it will prevent air-holes.

The Benskin Manufacturing Company, Canton, Ohio, report that they are the sole manufacturers of the "Perfect" Leather and wood fillets, which fillets form a perfect arc of a circle and give economy in making patterns. The company also manufacture brass dowels and are ready to made immediate shipment on white metal and brass pattern letters, rapping plates, etc.

It is reported that negotiations are now in progress for the consolidation of the National and the United Lead Companies. The latter is now dominated by the American Smelting and Refining Company, which practically controls the output of crude lead. The National Lead Company and the United Lead Company are the largest manufacturers of finished lead in the United States.

The W. G. Rowell Company, of Bridgeport, Conn., have been organized and have taken over the business of W. G. Rowell & Co., brass founders and finishers. The officers of the company are: D. Webb Rowell, president; Frank S. Hughes, vice-president; William G. Rowell, secretary, treasurer and general manager. The new company will continue to do the same line of work.

The Gilbert & Barker Company, of Springfield, Mass., have decided that they will not market the oil tilting furnace recently patented by them. They believe that there are now so many furnaces of this type on the market that the sale will scarcely repay them for the outlay for patterns, etc. If, however, these types of furnaces prove all that is claimed for them they may enter the field later.

The Hamilton Emery & Corundum Company, Chester, Mass., have been incorporated with a capital of $40,000. The officers are: President, Frank D. Hamilton, of Chester; treasurer and clerk, Alexander W. Napier, of Brooklyn, N. Y. The company have plans drawn for a two-story mill 40 x 120 and will install two motor wheels of 125 H. P. They expect to be in operation some time in July.

The Bridgeport Deoxodized Bronze & Metal Company, Bridgeport, Conn., report that they have just added an extension to their plant 45 x 60 feet and have put in a 10-ton Reading crane in addition to their 5-ton crane. This enlargement will make the main factory 200 x 75 feet. The company also think of putting up another addition to their foundry 70 x 60, which will make that building 155 x 60 feet.

The American Wire Washer Company, of Unionville, Conn., say that they shall not move to Hartford just now as reported. They manufacture washers out of wire which are made on their patented machines and which they believe will revolutionize the methods of making metal washers. H. C. Hart, the inventor of the machine and president of the company, holds a basic patent in the United States and Europe.

The Metal Manufacturing Company, recently incorporated at New Haven, Conn., with a capital stock of $10,000, have bought the plant of the Hotchkiss Manufacturing Company, of New Haven, including the machinery, stock and fixtures. The company will manufacture upholstery hardware, adding from time to time any profitable new lines they may develop. The officers are: E. K. Leffingwell, president; H. B. Eltonhead, secretary and treasurer.

The Brass Goods Company has been organized at Waterbury, Conn., for the manufacture of all kinds. The organizers are C. S. Dykeman, J. H. Woodward, W. W. Magee, R. F. Griggs and C. L. Holmes. The officers are: President, C. S. Dykeman; secretary, J. H. Woodward; treasurer, C. L. Holmes. The particulars of the enterprise are not yet made public, but it is understood that the company is closely affiliated with the American Brass Company and will establish themselves in the plant of Holmes, Booth & Haydens. It is said that this company will become the manufacturing part or "cutting-up" shop of the American Brass Company.

Metal Prices, June 1, 1904

METALS

	Price per lb.
TIN—Duty Free.	
Straits of Malaca	27.15
COPPER, PIG, BAR AND INGOT AND OLD COPPER—Duty Free. Manufactured 2½c. per lb.	
Lake	13.15
Electrolytic	13.00
Casting	12.85
SPELTER—Duty 1c. per lb.	
Western	4.90
LEAD—Duty Pigs, Bars and Old 2⅛c. per lb.; pipe and sheets 2½c. per lb.	
Pig Lead	4.35
ALUMINUM—Duty Crude, 8c. per lb. Plates, sheets, bars and rods 13c. per lb.	
Small lots	37.00
100 lb. lots	35.00
1,000 lb. lots	34.00
Ton lots	33.00
ANTIMONY—Duty ¾c. per lb.	
Cooksons	7.75
Halletts	7.25
Other	6.25
NICKEL—Duty 6c. per lb.	
Large lots	40 to 50
Small lots	50 to 75
BISMUTH—Duty Free	$1.50 to $2.00
PHOSPHORUS—Duty 18c. per lb.	
Large lots	45
Small lots	65 to 75
	Price per oz.
SILVER—Duty Free—Commercial Bars	$0.56
PLATINUM—Duty Free	19.00
GOLD—Duty Free	20.00
QUICKSILVER—Duty 7c. per lb. Price per Flask	47.50

Zinc—Duty, Sheet, 2c. per lb.; 600-lb. casks, 6.75c. per lb., open, 7.25c. per lb.

Tobin Bronze—Rods, Unfinished, 19c.

Tobin Bronze—Rods, Finished, 20c.

PRICE FOR ALUMINUM BRONZE INGOTS.

	Per pound.
2½ per cent	19c.
5 per cent	19½c.
7½ per cent	20½c.
10 per cent	21½c.

Manganese Bronze, Ingots	16½c.
Phosphor Bronze, Ingots	15 to 18c.
Silicon-Copper, Ingots	34 to 36c.

OLD METALS

	Buying.	Selling.
Heavy Cut Copper	11.25c.	12.00c.
Copper Wire	10.00c.	11.00c.
Light Copper	9.50c.	10.75c.
Heavy Mach. Comp	9.50c.	10.75c.
Heavy Brass	7.25c.	8.00c.
Light Brass	5.50c.	6.25c.
No. 1 Yellow Brass Turnings	7.50c.	8.25c.
No. 1 Comp. Turnings	8.50c.	9.50c.
Heavy Lead	4.00c.	4.15c.
Zinc scrap	3.75c.	4.00c.
Scrap Aluminum, sheet, pure	22.00c.	25.00c.
Scrap Aluminum, cast, alloyed	16.00c.	20.00c.
Old Nickel	15.00c.	25.00c.

PRICES OF SHEET COPPER

SIZES OF SHEETS.		96oz. & over 75 lb. sheet 30x60 and heavier	64oz. to 96oz. 50 to 75 lb. sheet 30x60	32oz. to 64oz. 25 to 50 lb. sheet 30x60	24oz. to 32oz. 18¾ to 25 lb. sheet 30x60	16oz. to 24oz. 12½ to 18¾ lb. sheet 30x60	14oz. and 15oz. 11 to 12½ lb sheet 30x60
		CENTS PER POUND.					
Not wider than 30 ins.	Not longer than 72 ins.	18	19	19	19	19	20
	Longer than 72 ins. Not longer than 96 ins.	18	19	19	19	19	20
	Longer than 96 ins.	18	19	19	19	19	21
Wider than 30 ins. but not wider than 36 ins.	Not longer than 72 ins.	18	19	19	19	19	21
	Longer than 72 ins. Not longer than 96 ins.	18	19	19	19	19	21
	Longer than 96 ins. Not longer than 120 ins.	18	19	19	19	20	22
	Longer than 120 ins	18	19	19	20	21	
Wider than 36 ins. but not wider than 48 ins.	Not longer than 72 ins.	18	19	19	20	21	23
	Longer than 72 ins. Not longer than 96 ins.	18	19	19	20	22	24
	Longer than 96 ins. Not longer than 120 ins.	18	19	19	21	23	27
	Longer than 120 ins.	18	19	20	22	25	
Wider than 48 ins. but not wider than 60 ins.	Not longer than 72 ins.	18	19	19	20	22	25
	Longer than 72 ins. Not longer than 96 ins.	18	19	19	21	23	28
	Longer than 96 ins. Not longer than 120 ins.	18	19	20	22	25	
	Longer than 120 ins	19	20	21	23	27	
Wider than 60 ins. but not wider than 72 ins.	Not longer than 96 ins.	18	19	20	22	27	
	Longer than 96 ins. Not longer than 120 ins.	18	19	21	24	29	
	Longer than 120 ins.	19	20	22	27		
Wider than 72 ins. but not wider than 108 ins.	Not longer than 96 ins.	19	20	22	25		
	Longer than 96 ins. Not longer than 120 ins.	20	21	23	26		
	Longer than 120 ins.	21	22	24	28		
Wider than 108 ins.	Not longer than 132 ins.	22	23	25			
	Longer than 132 ins.	23	24	27			

Rolled Round Copper, 3/8 inch diameter or over, 21 cents per pound. (Cold Drawn, Square and Special Shapes, extra.)

Circles, Segments and Pattern Sheets three (3) cents per pound advance over prices of Sheet Copper required to cut them from.

All Cold or Hard Rolled Copper, 14 ounces per square foot and heavier, one (1) cent per pound over the foregoing prices.

All Cold or Hard Rolled Copper, lighter than 14 ounces per square foot, two (2) cents per pound over the foregoing prices.

Cold Rolled and Annealed Copper, Sheets and Circles, wider than 17 inches, take the same price as Cold or Hard Rolled Copper of corresponding dimensions and thickness.

All Polished Copper, 20 inches wide and under, one (1) cent per pound advance over the price for Cold Rolled Copper.

All Polished Copper, over 20 inches wide, two (2) cents per pound advance over the price for Cold Rolled Copper.

Planished Copper, one (1) cent per pound more than Polished Copper.

Cold Rolled Copper prepared suitable for polishing, same prices and extras as Polished Copper.

Tinning Sheets, on one side, 2½c. per square foot.

For tinning both sides, double the above price.

For tinning the edge of sheets, one or both sides, price shall be the same as for tinning all of one side of the specified sheet.

Metal Prices, June 1, 1904

COPPER BOTTOMS, PITS AND FLATS

Net Cash Prices.

14 oz. to square foot, and heavier, per lb	23c.
Lighter than 10 oz	24c.
10 oz. and up to 12 oz	26c.
12 oz. and up to 14 oz. to square foot, per lb	20c.

Circles less than 8 in diam., 2c. per lb. additional.
Circles over 13 in. diam., are not classed as Copper Bottoms.
Polished Copper Bottoms and Flats, 1c. per lb. extra.

PRICE LIST FOR ROLL AND SHEET BRASS

Prices are for 100 lbs. or more of sheet metal in one order. Brown & Sharpe's Gauge the Standard.

Common High Brass	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Wider than and including	2 12	12 14	14 16	16 18	18 20	20 22	22 24	24 26	26 28	28 30
To No. 20 inclusive	.22	.23	.25	.27	.29	.31	.33	.36	.39	.42
Nos. 21, 22, 23 and 24	.22	.24	.26	.28	.30	.32	.34	.37	.40	.43
Nos. 25 and 26	.23	.24½	.27	.29	.31	.33	.35	.38	.41	.44
Nos. 27 and 28	.23	.25	.28	.30	.32	.34	.36	.39	.42	.45

Add ½ cent per lb. additional for each number thinner than Nos. 28 to 38, inclusive.

Add 7 cents per lb. for sheets cut to particular lengths, not sawed, of proportionate width.

Add for polishing on one side, 40 cents per square foot; on both sides, double this price.

Brazing, Spinning and Spring Brass, 1 cent more than Common High Brass.

Extra Quality Brazing, Spinning and Spring Brass, 2 cents more than Common High Brass.

Low Brass, 4 cents per lb. more than Common High Brass.

Gilding, Rich Gold Medal and Bronze, 7 cents per lb. more than Common High Brass.

Discount from List, 30 per cent.

PRICE LIST FOR BRASS AND COPPER WIRE

BROWN & SHARPE'S GAUGE THE STANDARD.	Com. High Brass	Low Brass	Gilding Bronze and Copper
All Nos. to No. 10, Inc	$0.23	$0.27	$0.31
Above No. 10 to No. 16	.23½	.27½	.31½
Nos. 17 and 18	.24	.28	.32
" 19 and 20	.25	.29	.33
No. 21	.26	.30	.34
" 22	.27	.31	.35
" 23	.28	.32	.36
" 24	.30	.34	.38

Discount, Brass Wire, 30 per cent.; Copper Wire, 40 per cent.

PRICES FOR SEAMLESS BRASS TUBING

From 2 in. to 3¼ in. O. D. Nos. 4 to 12 Stubs Gauge, 19c. per lb. Seamless Copper Tubing, 22c. per lb.

For other sizes see Manufacturer's List.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron Pipe size	¼	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	4½	5	6
Price per lb	31	29	20	19	18	18	18	18	18	18	18	20	20	22	24	25

BRAZED BRASS TUBING

Brown & Sharpe's Gauge the Standard.

									Per lb
Plain Round Tube,	¼	in.	up	to	2	in.,	to No.	19,	inc.	$0 35
" " "	⅛	"	"		¾	"	"	19,	"	36
" " "	⅛	"	"		⅞	"	"	19,	"	38
" " "	⅛	"	"		1⅛	"	"	19,	"	41
" " "	⅛	"	"		1⅜	"	"	19,	"	48
" " "	⅛	"	"		1⅝	"	"	19,	"	65
" " "	⅛	"	"		1¾	"	"	19,	"	1 00
" " "	⅛	"	"		1⅞	"	"	19,	"	1 50
Smaller than ⅛ inch										Special
2 inch to 3 inch, to No. 19, inclusive										38
3 inch										40
Over 3 inch to 3½ inch										45
Over 3½ inch										50

Bronze and copper advance 3 cents. Discount 30 per cent.

PRICE LIST FOR SHEET ALUMINUM

PLATE AND SHEET PRICE LIST.—B. & S. GAUGE.

Prices are for 50 pounds or more at a time. Less quantities, 5 cents per pound additional. Charges made for boxing.

Wider Than.. And Including..	*3 in. 12 in.	in coils.	6 in. 14 in.	14 in. 16 in.	16 in. 18 in.	18 in. 20 in.	20 in. 24 in.	24 in. 30 in.	30 in. 36 in.	36 in. 40 in.	40 in. 45 in.	45 in. 50 in.	50 in. 55 in.	55 in. 60 in.	Not wider than 6 in.	Sat. Fin. without Lacquer. One Side.	Polishing One Side.	Polished two sides double above prices.	Satin Finish two sides double above prices.
No. 13 & heavier			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
14			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
15			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
16			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
17			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
18			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
19			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
20			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
21			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
22			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
23			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
24			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
25			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
26			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
27			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
28			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
29			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
30			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
31			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
32			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
33			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
34			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
35 & 36			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
37 & 38			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
▶39 & 40			42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
.008" to .0015"	1 67		42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
Less than .0015"	1 96		42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
	2 22		42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
	2 42		42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8
	2 66		42	44	44	44	44	47	47	47	48	48	50	50	52	2	3	6	8

A additional charge for slitting coiled sheet in widths less than 3 in. and flat rolled sheets in widths less than 6 in.

All columns except the first are for Flat Rolled Sheets.

Discounts as follows are given for sheet orders over 200 pounds.

200 to 1,000 pounds	10	per cent. off list.			
1,000 to 2,000 "	10	per cent. and	2	"	"
2,000 to 4,000 "	10	"	" 3	"	"
4,000 pounds and over	10	"	" 5	"	"

Sheets polished or satin-finished on both sides, double the price for one side.

Price Per Foot of Seamless Aluminum Tubing.

(CHARGES MADE FOR BOXING.)

Outside Diameter in Inches.	THICKNESS OF WALL IN STUBS' GAUGE. No. 12.	No. 14.	No. 16.	No. 18.	No. 20.	No. 22.	No. 24.	Outside Diameter in Inches.
1-4	.....	.....	.....	10	9	8	7	1-4
5-16	.....	.....	.....	11	9	8	7	5-16
3-8	.....	.....	.....	12	9	8	7	3-8
1-2	.....	.....	17	14	11	9	8	1-2
5-8	.....	.....	21	16	13	12	.....	5-8
3-4	.....	.....	25	19	16	14	.....	3-4
7-8	.....	.....	28	22	18	16	.....	7-8
1	.....	.....	30	25	21	19	.....	.....1 00
1 1-4	.....	.....	36	30	25	.....	.....	.....1 1-4
1 1-2	.....	52	43	35	28	.....	.....	.....1 1-2
1 3-4	.....	60	50	41	33	.....	.....	.....1 3-4
2	84	68	58	47	37	.....	.....	.....2 00

Discount 20 to 30 per cent.

ALUMINUM

Drawn Rod and Wire Price List.—B. & S. Gauge.

Diameter B. & S. G'ge.	0000 to No. 10	No. 11.	No. 12.	No. 13.	No. 14.	No. 15.	No. 16.	No. 17.	No. 18.	No. 19.	No. 20.	No. 21.	No. 22.
Price per lb	$ 38	38½	38½	0 39	39½	0 40	40½	0 41	0 42	0 43	0 44	0 47	0 52

200 lbs. to 30,000 lbs., three cents off list.

30,000 lbs. and over, four cents off list.